APPENDIX F

SELECTED METHODS OF RANKING SITES

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This appendix addresses prioritizing or ranking mining sites for attention. The first section presents some principles about ranking inactive and abandoned mine sites (IAMs) in priority order for EPA consideration. Although regulatory authority may be sufficient for EPA to consider action at many mine sites, EPA is not likely to have the resources available to take action at all sites. Thus, some method of ranking the sites in priority order is advisable. The second section of this appendix provides some examples of priority ranking systems.

1. METHODS OF SETTING PRIORITIES

1.1 Overview

Establishing priorities that will guide remediation efforts leading to environmental improvement is one of the most important challenges facing regulatory authorities as well as interested stakeholders. Identifying key considerations in this regard is one of the main objectives of this mining framework. Given the number of mine sites and potential environmental problems, the lack of a comprehensive data set to evaluate impacts of all past mining activities, and limited resources, EPA and other federal, state, and tribal regulatory partners need to "rank" geographic areas and sites for inventory, evaluation, and remediation.

There have been a number of inventory and priority setting mechanisms established to address the large population of abandoned mine sites. Most of these are well suited to the specific geographic area(s) they are intended for. Some of these systems include:

- The State of Montana's ranking system.
- The National Park Service's ranking system.
- Ranking systems developed by other federal agencies.

Given the large number of sites and the expense of mitigation using existing technologies, the public and private sectors will realistically probably never have sufficient resources to perform field inventories or clean up all mining sites. Therefore, we must develop a process that ensures that our efforts go to areas and sites that will yield the greatest benefits in the most cost-effective manner. Cooperation among a wide range of stakeholders (federal agencies, states, tribes, nongovernmental organizations, and private industry) with different authorities, outlooks, priority-setting processes, and goals will require sharing of information and resources, and may require some compromise among different program objectives. EPA's numerous authorities and responsibilities for addressing health and environmental impacts at IAMs require the Agency to work at several different stages of the priority setting process.

The principles described here are applicable primarily to inactive and abandoned mines, rather than to proposed or active mines. The reason for this distinction is an assumption that proposed or active mines will typically be the subject of operating permits or requirements that will be the vehicle and trigger for gathering necessary information about proposed or active mining operations and any associated

environmental and human health impacts. However, many of the principles articulated below are clearly applicable to proposed and active mines as well. For example, characterization of priority areas within a watershed will require inventories and information on both active and inactive mining activities in order to determine the highest priority sites for future actions.

EPA believes priority setting mechanisms must be established at multiple levels to most effectively address the range of issues posed by the large universe of mine sites. The next few pages describe an approach for setting priorities for action at four different geographic scales: National, regional/state/tribal, Mining Area (watershed, mineshed), and Site. Objectives at each level can include:

- At the **national level,** to portray accurately the scope of the IAM problem and the magnitude of resources needed to address it.

- At the **state level**, to identify impacted watersheds that deserve priority attention.

- At the **tribal level**, to be cognizant of Tribal trust responsibilities.

- Within **priority** areas, to develop effective interagency approaches for prioritizing individual mine sites for action.

- At the level of the **mine site**, to determine which regulatory or non-regulatory mechanisms are most effective in addressing the problems of a given site.

Table F-1 presents a summary of key components for setting priorities for action on inactive and abandoned mines for each of the four scales. The following set of considerations are reviewed at each level:

- The **major goals** to be reached and the specific type of activity associated with meeting the overall goal. This would include consideration of the key public and private parties (agencies, states, other stakeholders) who are responsible for the decisions/actions.

- The key **criteria and specific analyses** required to set the priorities and ensure success in meeting the different goals.

- The principal **outputs/action** that are appropriate for each level, in accordance with goals and the criteria/analyses reviewed.

Table F-1 Setting Priorities for Action on Inactive and Abandoned Mines (IAMs)

SCALE	GOALS	TYPE OF ACTIVITY	WHO	KEY CRITERIA*	ANALYSIS
National	Determine nationwide environmental degradation from IAMs Identify high-priority states, tribes, agencies and regions for budget and program action	Congressional decisions on budget and legislative agenda Federal Agency decisions on budget, program, research and regulatory agenda	Congress, EPA, DOI, DOA, Governors, Tribes, National Stakeholders-MPC, companies	National human health and ecological impacts Total Administrative and Mitigation Costs Federal Trust Responsibilities	Estimate size and scope of nationwide mining problem based on state, agency and tribal input.
State, region or tribe	Identify priority areas by ranking areas for action and/or near-term evaluation	State/Regional Assessment or Program Activity such as: • 305b reports • Nonpoint source assessments • NPDES General permit priorities • CERCLIS site entry • State/Tribal Groundwater Protection Programs • State/Tribal Water Quality Standards Review • State//Tribal/Regional Enforcement priorities	States EPA Federal land managers Tribes Regional Stakeholders	Impaired watersheds, habitat, groundwater, airsheds, etc. Location of historic mining districts Population centers and most sensitive individuals Most sensitive species, communities, ecosystems Institutional capabilities	Critical area identification Mineral district pollution projections Geographic overlays of risk assessment data at the mineshed, watershed level
Historic Mining Area (Mineshed, Watershed, Land Management Area, etc)	Ranking of sites for immediate action and/or near-term evaluation	Conduct area investigations such as: • Area-wide PA/SI • Mass loading evaluations (TMDLs; air) • NPDES General Permit • Fed. Land Mgmt. Planning	States EPA Federal Land Managers Tribes Regional Stakeholders Local Stakeholders	Extent of environmental and human health risk - all media Achievable cleanup goals (tech. feas., cost-effect., total cost) Enforcement potential Partnership potential Ownership Funding sources	Estimate discharge, transport and risk to receptors Site identification, including appropriate size Regulatory options assessment and tool box analysis
Site	Mine site mitigation Environmental improvement via reduced ecological and human health risk Evaluate post-mitigation success	Design and funding actions such as: • RI/FS type studies (CERCLA) • A106 request (Progr. fund. req) • NPDES Permit enforcement	All of Above, plus Specific parties (e.g. private landowners, payees)	Tech. Feas. (Design criteria such as chemical loading; site-specific data) Cost/Effectiveness Funding source Enforcement potential	Evaluation of site • specific data and selection of remedy, or • action

1.2 Goals of Priority Setting

The purpose of the priority setting process in this framework is to help decision-makers organize information and make consistent and rational judgments about which strategy of evaluation and action to pursue in order to meet both short- and long-term goals of environmental improvement. Cross-programmatic cooperation, team building and integration are key elements of this process. Because the type and scope of decisions are fundamentally different at various scales of resolution, the process provides a flexible approach that works at all of these different levels. For example, Congress is responsible for appropriating federal resources to the entire nation based on the general needs of large, multi-state geographic areas, states, tribes and federal agencies and consideration of other competing national issues and programs. As we narrow the geographic scope, the decision-makers change from federal to state/tribal, and to local. The goals, activities, criteria, analyses, strategies and priorities become successively more site-specific and complex as we move to the site level. In addition, as priority setting moves closer to the site level, there will likely be a demand for more precise data, and for greater coordination and communication among all involved parties.

1.3 Criteria in Priority Setting

In setting priorities for action which will result in mitigation of inactive and abandoned mines and environmental improvements, regulatory authorities need to consider a range of specific technical, scientific, institutional, and other criteria upon which to base national, state, area, and site-specific decisions. Further, the precision and type of information used at each different scale of the decision-making process will vary. High precision data can be used at a very small scale while qualitative data may be useful only at larger scales.

The following criteria need to be considered and evaluated in each level of the priority-setting process to determine the priority for action.

- Extent and type of environmental and human health risk.
- Total administrative and mitigation costs.
- Technical feasibility.
- Cost-effectiveness of activity.
- Partnership potential.
- Availability and type of data/information.
- Enforcement potential.
- Source of funds.
- Ownership.
- Institutional capabilities.
- Tribal Trust Resources.

1.4 Outputs of Priority Setting

One of the goals of the framework is to develop, at each geographic scale, a coordinated, systematic approach to assess and prioritize risks associated with IAMs, and to establish priorities for mitigation based on environmental and human health risk, as well as other key criteria such as resource availability and cost-effective technologies. This will ultimately result in clean-up of abandoned mine sites in the most efficient and effective manner possible in coordination with all affected and interested parties.

Cooperative programs such as the Clear Creek Initiative (Colorado) and Montana Ranking System can provide models for using both national and area-wide approaches, involving parties with different outlooks and goals and operating under numerous statutory authorities. Possible specific outputs of the priority ranking system could include:

- Establishing priorities for implementing the NPDES storm water comprehensive watershed risk-based approach for federal lands pursuant to Clean Water Act Section 402(p) and for reviewing multi-sector storm water watershed approaches for the private sector.
- Ranking CWA Nonpoint Source Projects (Section 319) for funding priorities.
- Prioritizing mine waste control demonstration projects pursuant to CWA Section 107.
- Entering sites on private and public lands into CERCLIS and initiating the PA/SI process pursuant to CERCLA Section 116.
- Prioritizing NEPA reviews for mining that will impact waters of the U.S.
- Prioritizing facilities for performing A-106 audits pursuant to Executive Order 12088.
- Establishing priorities for action under state Groundwater Protection Programs.
- Establishing priorities for mining-related technology and research development initiatives.
- Establishing priorities for remediation initiatives.

This geographic, hierarchical system for prioritization may be entered at any level; and one can move both up or down in scale within the hierarchy, for example, from the national scale down to the site level, based on the resolution of the data. Once geographic areas of concern are identified, a number of criteria can be used to further prioritize or categorize sites at this new scale. Alternatively, if one had sufficient data to take a response action at a site, evaluating the response action within a watershed to determine if goals within the larger area will be advanced by this activity may be appropriate.

The area-wide approach directs site investigation and cleanup activities towards the broad scope of problems affecting an area. Better decisions are made when the cumulative impacts of all mine sites in the area are considered and addressed. The basic premise of the framework for addressing mine sites is to identify and prioritize sites at the same time as known problems are being addressed. In the short term, actions can be initiated at many of the most damaged areas and sites while data gaps are filled for other less-characterized areas. In the long term, better information used in conjunction with site specific refinement of methods and approaches will result in the most effective cleanups and use of limited resources.

1.5 Multi-Level Priority Setting

National Level

Goal - At the national level, Congress, federal agencies, states, and tribes should determine the magnitude and scope of national environmental degradation resulting from IAMs. Further, they can cooperatively identify the high priority states and agencies for targeting resource appropriations as well as program, research, legislative and other future agendas. One key challenge in priority setting at this level is to balance resources devoted to environmental versus safety threats (e.g., open airshafts and adits, crumbling mill works, dams, and unstable tailings piles). Each can be significant but they are generally addressed under different legal authorities.

Criteria/Analysis - The key criteria to be used at this national level would include the relative extent and type of environmental and human health (including safety) impact in each state/tribal or Federal Land Management (FLM) area, and general estimates of the total public and private costs of mitigating IAMs. Specific information and analyses performed might include identifying non-coal mining activities within the state or tribal area, estimating the total number of mine sites, identifying major types of suspected or measured statewide impacts (e.g., number of miles of streams not meeting designated uses) as well as other indicators that the state or tribe has identified which qualify or quantify abandoned mines as an environmental problem.

Outputs - The output would be a large scale, nation-wide map or summary which identifies states, tribes, regions and/or federal land areas of highest priority where program, evaluation, budget, and other activities should be *initially* focused. A national approach that ranks *individual* sites for mitigation would require an extraordinary commitment, and would likely not be an efficient use of our current limited resources.

State, Tribal and/or Federal Land Management Unit Level

Goal - At this scale, priority setting should occur at the state, regional or federal land management level. The goal here is to identify priority geographic areas (e.g., watersheds, minesheds, Federal Land

Management unit) that are most impaired or threatened by mining activities and target them for action or near-term evaluation. It is crucial that this identification and ranking be performed jointly and cooperatively using a team-building and information-sharing approach. Key parties here include states, affected federal agencies, tribes, mining interests, environmental groups, local organizations, and other regional stakeholders.

Criteria/Analysis - The large number of individual sites makes a geographic, regional evaluation of mined areas more effective and efficient than a systematic effort of assessing individual sites. Although mine sites can be isolated, they are more frequently clustered in historic mining districts. Consequently, there are often cumulative impacts from multiple sites. In general, most information resources, inventories and data collections should be directed to known or easily identified problem areas. Therefore, it is suggested that this area evaluation be based upon mineshed-level data (e.g., geographic watershed areas delineated by the USGS as cataloging units within the Hydrologic Unit Code system).

At this level, the approach could develop a list of priority areas by compiling and overlaying data based on the following key criteria:

- Regional/state measures of the extent of actual human health and environmental impacts based on regional and/or local assessment reports (e.g., CWA Section 305(b) reports, nonpoint source assessments). Specific components might include impaired surface waters, watersheds and groundwaters, degraded habitat, degraded airsheds, disturbed terrestrial areas, and open mineshafts.

- Specific population centers and locations of most exposed individuals and critical ecological areas containing most sensitive species, communities, and ecosystems.

- Location of historic mining districts and estimates of mineral district pollution projections.

Outputs/Action - This information will be used to generate a list of priority minesheds which can be targeted for more site-specific evaluation. The major advantage of using an area-wide approach is that site investigation and remediation activities can be directed toward the broad problems affecting an area, including considering and addressing the cumulative impacts to all resources from all mine sites in the area. The ranking derived at this level could lead to different types of program and evaluative activities, including setting NPDES permit priorities, or working with state, tribal, or other federal agencies to develop comprehensive approaches to addressing mine site impacts.

Watershed Level

Goal - The purpose of assessment and prioritization at the watershed level is to evaluate and rank specific sites causing threats to human health and ecological resources and then rank them for action and/or

near term evaluation. Also key to this site prioritization is the development of an area-wide plan to assess and prioritize additional sites within the area that are not adequately characterized. This process directs most resources toward investigating and assessing areas where actual environmental impacts are documented while continuing to identify and characterize additional high-risk areas.

Criteria/Analysis - Within the higher ranked geographic areas of concern (watershed, mining district, or section of a land management area) one of the major criteria to consider in developing the ranking system is the extent and magnitude of specific risk to human health and safety and to ecological resources from all media. Key indicators include areas where individuals/wildlife are exposed to contaminated soil; where drinking water supplies exceed Maximum Contaminant Levels; where acute or chronic water quality standards are exceeded; or where terrestrial/riparian habitats are severely degraded. In many instances, water quality problems represent a primary indicator of overall environmental degradation.

Where more detailed data are available, a more precise determination of risk can be determined by estimating discharge transport and exposure pathways in all media or by identifying specific locations of physical hazards. At this level, evaluating existing or potential human health and environmental risks should take into consideration the actual or potential presence of threatened or endangered species, presence of critical environmental resources such as wetlands or breeding habitat, and the specific exposure potential to the receptors of concern. Other variables to consider, if information is available, include the magnitude of existing or potential damage including concentration, toxicity, severity of impact, geographic extent, reversibility of damage, and persistence of pollutants of concern.

Other important criteria to evaluate and address in the ranking system at this level include achievability of cleanup goals (e.g., availability, cost and cost-effectiveness of monitoring and remedial techniques), ownership patterns, source of funding for different actions, and the potential for partnerships to share resources and information.

Outputs/Action - The analyses performed at this level should determine which priority watersheds, minesheds or planning areas should have more detailed, site-specific assessments and should also identify watersheds and other areas which are of a lower priority and may therefore require limited or no action. Information collected and evaluated at this level could be used, for example, to develop a CERCLA preliminary assessment and site investigation, identify priority cleanup actions, or collect data for various compliance and permit evaluations.

Site Level

Goal - At this scale, the purpose is to develop a more comprehensive assessment and characterization of individual mine sites within targeted minesheds and watersheds, in order to remediate the sources that are the most damaging to human health, safety and ecological resources. At this level, the

goal is to use a more refined approach for designing specific mitigation activities. In addition, regulatory authorities may need to implement a program to evaluate the success of short- and long-term remediation efforts.

Criteria/Analysis - The major factors used to rank individual mine sites/sources within an area should be based on the impacts observed in and risks associated with the specific area. The ranking of sites at this level as well as the evaluation and data collection performed will likely be driven by area-specific concerns and conditions. For example, if the major environmental impacts in an individual watershed are found to be directly related to lead levels in stream waters and sediments, the high priority sites targeted for mitigation within that watershed should include those that are discharging lead to streams.

Other key criteria for ranking sites for mitigation include the technical feasibility and specific cost/effectiveness of remediation methods. Evaluation of "hot spots" will require detailed site investigation and resource evaluation and should be performed by personnel who have expertise in mining site remediation and resource assessment. "Best professional judgement" of qualified personnel will need to be employed at the various levels of site and resource assessment. Practical, feasible technical and scientific approaches should be considered to determine the overall priorities for site action.

Outputs - The approach at the site level focuses characterization and remediation activities on areas of greatest human health and ecological concern by determining which specific sites would be the most cost-effective to mitigate and provide the greatest environmental improvements. For instance, this approach can prevent situations where an upstream site is remediated while at the same time downstream problems continue to cause impacts. Typical outputs at this level might include RI/FS type of studies, NPDES permitting and enforcement actions, or specific program funding requests.

1.6 Implementation Issues/Challenges

One of the major challenges associated in implementing a multi-level priority setting system such as the one described here lies in the fact that there are currently a number of systems in use that are effective at addressing certain parts of the problem. In addition to needing to mesh with these existing systems, a related issue is defining and agreeing upon the successively smaller boundaries of areas and then coordinating the activities and resources of all interested parties. In addition, all appropriate sources of existing information will need to be collected and reviewed in order to characterize geographic areas and mine sites causing ecological and/or human health problems within those locations. It will be critical to develop the most resource-effective approach to integrate data across programs and across media. Team-building, sharing data and information, and leveraging of staff, equipment and funding are critical to the success of this area-wide approach.

A second major challenge is that the requirements of specific statutes and regulations often drive action on a site-specific or media-specific basis, independent of larger area-wide evaluations, considerations

and conditions. This may cause some difficulty in applying discretion to the development of specific remediation priorities. A third problem is how to ensure that progress on known sites is not delayed because of the time and effort required to establish priorities for action at the different levels. Many of these areas, particularly the larger and/or more complicated sites and geographic areas, have already been identified and characterized. It is critical that all parties reach agreement at an early stage about these high priority sites so that the next appropriate steps that will lead to speedy site mitigation and environmental improvements can be identified.

A fourth challenge lies in the need to develop a comprehensive, cost-effective and successful area and site-level ranking system that includes all media and receptors. Currently, many of the applied mine site ranking/assessment systems, such as Superfund's Hazard Ranking System (HRS) or the federal land managers' systems, are tailored for assessing and categorizing individual sites. They generally do not identify problem areas or characterize the overall condition of an area (e.g., watershed, airshed, or ecosystem). Similarly, the cross media NCAPS is used to rank/prioritize sites for RCRA remedial action. In contrast, the water body assessments required by the Clean Water Act (e.g., Section 305(b) reports) cover large areas, yet do not always identify specific sites of concern. Further, no current priority system adequately identifies risks to human health and evaluates them along with threats to special areas of concern, human safety risks from open shafts or effects to ecological resources at the species, community, and ecosystem level. There is a need to improve the ways in which priority ranking systems factor the components of the larger ecosystem level in with the needs and efforts at the site-specific level.

2. SELECTED EXAMPLES OF RANKING SITES

At present there are numerous programs being developed or already underway within states and within other federal agencies to identify, inventory, prioritize, and/or otherwise address mining related issues. Of particular interest are those programs which include explicit methods for prioritizing activities from a large population of options, such as ranking methods for sites targeted for possible remedial action. Accordingly, this appendix is intended to provide background information on a selection of existing programs for ranking sites, starting with several programs designed specifically for mine sites and then several applicable to other types of sites..

2.1 Montana Abandoned and Inactive Mines Scoring Systems (AIMSS)

Montana's AIMSS is a fully developed and implemented prioritization methodology which has allowed the state to establish a ranked list of "90 – 95 percent of the worst mines in the State" based on a previously developed inventory of roughly 6,000 abandoned mine sites and extensive site characterization data. The AIMSS is based on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Hazard Ranking System (HRS) (see section 7 below) with significant modifications employed to fit mining scenarios. The model's output provides a numeric score for each site analyzed, enabling relative ranking of the sites, with no absolute measure of risk implied. According to state

officials, implementation of AIMSS cost $0.9 million for 273 sites in less than one year, roughly $3,100 per site[1].

The development and implementation of AIMSS has relied on several important phases, including development of a state-wide inventory of abandoned mines, systematic investigation of all of the mines to yield comparable data for each, professional land manager surveys to aid in identification of problem sites, and development of the AIMSS itself. Further, having developed the priority list of mines, the state is moving forward with the next phases of its abandoned mine land program. These are briefly discussed below.

Inventory Development. Having certified that all coal mine reclamation activities have been completed, Montana is authorized to expend Surface Mining Control and Reclamation Act (SMCRA) Abandoned Mine Lands fund resources on non-coal abandoned and inactive mine reclamation. During the late 1980s, Montana developed a state-wide inventory of non-coal mine lands. The process included use of a five-page site investigation form which required investigators to record observations beyond those principally related to safety hazards, such as the presence of discharging adits, low pH or high conductivity discharges, the presence of a mill at or near the property, acid generation indicator minerals, the presence of tailings, and so forth.

Pre-ranking of Inventoried Sites. The Abandoned Mine Reclamation Bureau conducted a rough sorting of the mine inventory based on professional land manager surveys as well as analysis of the investigation results for the total mine pool. The population of mines was searched for a number of hazard indicators such as tailings, low pH discharges, etc., with those sites not presenting any of the indicators eliminated from the priority pool. Land managers from the Forest Service, Bureau of Land Management (BLM), Department of State Lands, mining districts, and health departments were then asked to identify any properties within their jurisdiction known or believed to present environmental hazards. The canvass results and the rough screening results were then compiled to yield a list of 273 mines believed to represent the majority of the worst mines in the state[2].

[1] Note that in 1993, 273 sites were ranked. An additional 58 sites were processed in 1994, with approximately 50 sites from the total pool eliminated based on findings of comparatively low risk, resulting in a total of around 280 mines on the final inventory of problem sites. Also note that the estimated cost of implementation does not include the costs associated with developing the initial AML inventory nor with the modification of the HRS to yield the actual AIMS system.

[2] Note that the state reports a good match between the list of mines identified on the basis of profession judgment and those selected according to rough screening of empirical data. However, there were also some "surprises," in which sites not known or identified by land managers came to attention through historic file searches or other means and subsequently were ranked very high in priority. Similarly, several sites suspected of presenting high potential hazard were found on closer examination to be relatively benign.

Site Characterization Investigations. In the next phase of the program, state officials conducted systematic site characterization investigations at each of the 273 mines previously identified. These investigations involved visual site inspection as well as sampling and analysis. Portable sampling and analysis equipment (i.e., X-ray fluorescence (XRF) units) was employed to guide the number of samples to be collected as well as to provide additional sampling data points for each site at lower cost and in less time. The total cost for site characterization was estimated at $0.9 million, or $3100 per site.

Development of AIMSS. AIMSS was developed based on the HRS, with significant modification designed to yield a more realistic comparison between mine sites than would be possible using the actual HRS. For instance, given the frequency of occurrence of high manganese oxide concentrations at mine sites, AIMSS does not use manganese concentrations in determining risk. Moreover, AIMSS was developed to consider multiple constituents of concern at the concentrations observed in site samples, in contrast to HRS (see section 7), which is based on the contaminant of concern observed to be present in the highest concentration. Data collected for the priority mine were then input into the model to yield ordinal ranking according to potential hazard.

Current and Future Directions. Once the list of mines presenting environmental hazards was compiled, the state was faced with the task of determining how best to act upon these data. One of the ongoing activities is to identify past and present owners/operators of the identified sites in an effort to determine whether a viable potentially responsible party (PRP) exists. Another ongoing effort is to overlay the 273 sites with geographic information such as watershed boundaries and wetlands to put the sites in "environmental context." It is hoped that this process will further refine the ranking to identify sites or areas most worthy of immediate attention.

2.2 Bureau of Mines Abandoned Mine Lands Inventory and Hazard Evaluation Handbook

In response to the need for BLM, the Forest Service, and other land managers to develop inventories of abandoned mines within their jurisdictions, the former Bureau of Mines developed the Abandoned Mine Lands Inventory and Hazard Evaluation Handbook. The Handbook was designed to guide consistent data collection for all mine lands within a geographic area up to the size of a National Forest and to allow systematic comparison of inventoried mine lands with respect to hazard potential. The 4-phase inventory and evaluation process progresses from identification and characterization of all mine lands within a geographic area based on file and map reviews to detailed site investigation of sites selected from the resulting inventory on the basis of a rough pre-screening analysis. The final screening level phase yields a numerical indication of the relative hazard of all sites investigated, with no estimation of absolute risk implied.

To date, no agency has adopted the Handbook to be applied to all of the public lands within its jurisdiction. However, both the Forest Service and the BLM have contracted with the Bureau of Mines to perform inventory and investigation within individual forests and resource districts.

Forest Service Lands in Washington State. The Bureau of Mines has conducted an inventory and pre-field screening of abandoned mine lands on all Forest Service lands within the State of Washington. The inventory effort was initiated as part of the Forest Service's Federal Facility Compliance Program. The methodology closely followed the process for inventory and initial characterization of mine lands presented in the Handbook. The pre-field screen was based on qualitative indicators of hazard and resulted in identification of 49 "A Category" sites from a pool of 2,208 sites on Forest Service lands in Washington. The intent was then to incorporate the inventory into a Geographical Information System (GIS) format to facilitate prioritization of investigations based on spatial characteristics of the sites.

BLM Use of Handbook. BLM is in the process of developing a National Abandoned Mine Lands (AML) strategy. As part of the design effort, BLM is evaluating the suitability of the Handbook and other inventory and prioritization tools for identifying priority sites on BLM lands throughout the country. The Handbook methodology was applied to the Winnemucca District in Nevada. As with the Forest Service study, the Winnemucca study included only the initial inventory and pre-field screening phases of the Handbook approach. Additionally, a number of sites from the mine inventory were selected at random and visited to allow verification of pre-field screening results.

2.3 Colorado Demonstration Project Program

Under the Colorado Demonstration Project (CDP) program, the State of Colorado selects and allocates Clean Water Act Section 319 (nonpoint source) grant funds to address inactive and abandoned mine sites in the state. Through early 1995, 27 individual grants have been awarded for 16 mining projects. The total funding has been over $2 million (approximately $500,000 per year). Site selection and grant allocations are approved by EPA Region VIII. Information on the CDP program was obtained from Greg Parsons of the Colorado Department of Public Health and the Environment, who is the program coordinator.

The broad basis for the program is the state's Section 319 water management plan (i.e., the plan for addressing statewide nonpoint source pollution). From the management plan and an associated database, the state identifies watersheds with water quality problems. This identification serves as the basis for determining/prioritizing sites for CDP/319 program funds. In making these selections, the state considers a number of technical, political, and resource factors in determining/prioritizing sites for CDP/319 program funding. These factors include:

- Which sites will be addressed under other programs (without CDP/319 program resources)
- Severity of environmental impacts and risks

- Site accessibility, feasibility, and ease of remediation
- Which sites will serve as good "demonstration" projects for remedial measures.

Beyond the above factors, the state also recognizes that CDP/319 program funding and other state resources available for abandoned mine site remediation (the Colorado Division of Minerals and Geology also participates in the CDP program) are almost always insufficient to complete the projects. Therefore, an additional factor in the selection process is the ability to form partnerships (i.e., the potential for obtaining further resources and participation from federal agencies, local governments, academia, environmental groups, and private industry). Many of the current projects (e.g., French Gulch and Chalk Creek) represent cooperative efforts among a wide range of diverse interested parties.

Of specific note, the program has undertaken several watershed-related projects (as opposed to individual site-related). Along with the Rocky Mountain Headwaters Initiative (see section 5 below), the CDP program is providing funding/services to the Animas watershed project (aimed at defining impacts and performing remediation throughout this watershed). The CDP program also includes funding for prioritizing and remediating abandoned mine sites for remediation in the Mosquito Creek watershed.

According to the state, the most significant difficulty associated with the CDP program is the potential for assumption of liability (CERCLA and Clean Water Act) by non-state/federal project participants. The state avoids CERCLA liability through an agreement with EPA Region VIII that provides that projects are clean-up actions. However, other project participants risk assuming such liability and this tends to limit "good Samaritan" actions. In addition, project involvement can lead to the need for the state to obtain NPDES permits and ensure compliance with water quality standards (which is often not possible). An additional "difficulty" is that the requirements of the 319 process focus on remedial actions/best management practices rather than site characterization activities. As a result, site investigation activities cannot be funded unless there is a clear need for remediation. Further, the program can lead to remedial measures being undertaken before problems are fully understood.

Overall, like other similar projects, implementation of the CDP program has been a learning process. The state recognizes the site-specific challenges associated with mine site remediation and virtually every project provides lessons learned. One major finding has been the advantages of developing and implementing source controls (i.e., measures that minimize pollution generation), rather than conventional treatment techniques that require perpetual care.

2.4 Rocky Mountain Headwaters Initiative

The Rocky Mountain Headwaters Initiative is similar to other major EPA initiatives designed to address water quality concerns in a specific geographic area (e.g., the Chesapeake Bay and the Great Lakes programs). The Initiative was initially developed to addressed mining-related watershed impacts in the mineralized Rocky Mountain areas of Region VIII. However, it was expanded to fund projects in other

Regions. For FY 1994, 20 projects received approximately $1 million of funding. Information was obtained from Jim Dunn, the EPA Region VIII coordinator for the Initiative.

The goal of the Rocky Mountains Headwaters Initiative is to fund mining-related demonstration projects aimed at addressing water quality impacts from inactive and abandoned mining operations that are not being addressed through other programs. The Initiative is a nonregulatory tool and funding is limited to nonprofit entities (other federal agencies, states, universities, local non-profit groups, etc.). Categories of water management projects include:

- Innovative Technology Applications
- Scientific Foundations (i.e., applied research projects)
- Methods and Protocols
- Environmental Restoration
- Data Acquisition and Management
- Public Involvement/Agency Coordination/Outreach.

According to the Region, the project selection/prioritization process remains somewhat subjective (although developing more standardized protocols is a goal for this year). Site selection and program oversight are performed by a multi-disciplinary, cross-programmatic team of EPA Region VIII staff. One key factor in project selection is an emphasis on partnership building. Funded activities tend to be components of cooperative efforts among federal, state, local, public interest, and private sector groups. In addition, the region recognizes the many site-specific challenges posed by mine site remediation. Therefore, projects selected for the Headwaters Initiative are often tailored towards providing tools to assist in site characterization and remediation. For example, several projects focus on development and assessment of methods and protocols for mine site/watershed assessment. Other funded projects involve evaluation of innovative technologies. Finally, many of the selected projects focus on watershed characterization and remediation, including extensive work in the Upper Arkansas River, Upper Animas River, and Clear Creek watersheds. Upper Animas Creek work is also being funded under grants from the Colorado Demonstration Project program.

The Region is currently developing a report on the results to date and lessons learned from the Initiative. This report will include a description of techniques/protocols that have proven to be particularly successful in characterizing, prioritizing, and remediating inactive and abandoned mine sites.

2.5 South Dakota Abandoned Mined Lands Inventory Act

In 1993 the South Dakota legislature passed the Abandoned Mined Lands Inventory Act authorizing the Department of the Environment and Natural Resources (DENR) to inventory abandoned mine lands in the Black Hills region of the state. The Act establishes a fund for the inventory effort (derived largely from monies raised through a now-discontinued tax on cyanide usage). In addition, the

state has received a grant from the Western Governors Association (WGA) to fund a "screening" program in conjunction with the inventory development effort.

The Act specifies that the inventory effort can not proceed until the DENR executes a Memorandum of Understanding (MOU) with EPA granting an exemption from CERCLA liability to the state and its contractors covering any reclamation activities on abandoned mines. According to DENR, the MOU is nearing completion. The South Dakota Mining Association and other interested parties have been included in development of the language of the MOU.

The screening methodology has not yet been determined. However, DENR indicates that the tool will consider both safety and environmental factors, and, given the MOU with EPA, will likely resemble HRS-type screening tools.

2.6 CERCLA Hazard Ranking System

Section 105(8)(A) of CERCLA requires that the National Contingency Plan (NCP) include criteria for determining priorities among releases or threatened releases of hazardous substances, pollutants and contaminants, throughout the United States for the purpose of taking remedial action. Appendix A of the NCP (40 CFR, Part 300 Appendix A) contains these in the form of the Hazard Ranking System (HRS).

Section 105(8)(B) of CERCLA requires that the NCP, based on Section 105(8)(A) criteria, include a list of national priorities among the known or threatened releases throughout the United States. EPA describes the purpose of this National Priorities List (NPL) to be a source of information, to be used by EPA, the states and the public for identifying sites that appear to warrant remedial action. Listing (of a site) does not require any action of any private party, nor does it determine the liability of any party for the cost of cleanup at the site. EPA generally uses the NPL as the action list for evaluating remedial response and enforcement action under CERCLA. The NPL now includes over 60 mining-related sites.

The revised HRS assesses the relative risk among sites through evaluation of four migration pathways: (1) ground water migration; (2) surface water migration (through drinking water and human and aquatic food chain); (3) soil exposure (through resident population and nearby population); and (4) air migration. Within each pathway, sites are evaluated based on three factor categories: (1) likelihood of release (likelihood of exposure for soil exposure pathway); (2) waste characteristics; and (3) targets. Pathway scores are determined based upon the multiplication of factor category values and normalization to 100 points. The total site score (including all relevant pathway scores) is obtained by combining the pathway scores using the mathematical technique of root-mean-square. This mathematical technique results in higher scoring pathways contributing more significantly to the total site score than lower scoring pathways.

2.7 Priority Ranking Under Clean Water §303(d), TMDLs

The Clean Water Act includes numerous provisions requiring prioritization and ranking of potential actions, either in the statute or in its implementing regulations. One example is §303(d), which directs states to establish Total Daily Maximum Loads (TMDLs) for certain quality-limited waters. The TMDL approach attempts to provide a water quality-based mechanism for establishing point and nonpoint source controls for waters which have not achieved applicable water quality standards even after implementation of technology-based and other water quality-based controls.

When establishing its priority ranking for TMDL development, states must take into account the severity of pollution affecting the waters as well as the relative value and benefit of the waters to the state. Among the criteria listed in TMDL guidance to assist states in establishing priority ranking are:

- Risk to human health and aquatic life
- Degree of public interest and support
- Recreational, economic, and aesthetic importance of a particular water body
- Vulnerability or fragility of a particular water body as an aquatic habitat
- Immediate programmatic needs such as wasteload allocations needed for permits that are coming up for revision or for new or expanding discharges, or load allocations needed for BMPs
- Court orders and decisions relating to water quality
- National policies and priorities such as those identified in EPA's Annual Operating Guidance.

Section 303(d) does not identify an explicit method for ranking waters for TMDL development. Rather, the priority setting process is left to the states responsible for the program. States are encouraged to use a long-range planning approach to developing TMDLs for quality-limited waters and to consider broad geographic approaches to setting TMDLs. Note also that the 1991 "Guidance for Water Quality-Based Decisions: The TMDL Approach" identifies several approaches that may be considered by states in establishing their ranking and targeting systems. These include the priority setting systems applied under nonpoint source and Clean Lakes provisions of the Clean Water Act.

2.8 Priority Ranking Under the CSO Control Policy

In April 1994, EPA issued a national Combined Sewer Overflow (CSO) Control Policy intended to expedite Combined Sewer System (CSS) compliance with requirements of the Clean Water Act. In effect the policy outlines a process through which NPDES permit requirements and management controls may be

applied to CSOs on a worst-first basis while continuing to capture the remainder of the affected community through a long-term control planning function.

EPA released *Combined Sewer Overflows--Guidance for Screening and Ranking* (August, 1995 available from EPA's Water Resources Center) to help permitting authorities to identify those CSOs most warranting immediate attention. The recommended screening process relies on the use of existing data provided in Clean Water Act sections 303(d), 304(l), and 305(b) documentation and other sources to identify CSSs with the greatest likelihood of causing significant adverse impacts. CSSs identified through the screening process are then to be ranked according to seven criteria, with the final total scores for the CSSs enabling an ordinal ranking of all CSSs within a population of regulated entities.

In general, the criteria used to rank CSSs under this process depend on the existence of ongoing impacts, the potential for impacts to sensitive or protected resources, the size and nature of the receiving water affected by a CSO, proximity to drinking water sources, and the suspected presence of toxics. Additionally, the Guidance documentation includes certain default assumptions intended to lead to "worst-case" estimation of risks posed by a CSS. For instance, a CSS score is to reflect the maximum score attributable to any CSO within the CSS for each of the criteria.